AN ANNOTATED BIBLIOGRAPHY ON THE MACROZOOBENTHOS AND AQUATIC MACROPHYTES OF THE ST. CLAIR RIVER LAKE ST. CLAIR AND THE DETROIT RIVER

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Introduction

This bibliography is the result of a search for information on the macrozoobenthos and aquatic macrophytes found in the SCDRS on ten online data bases: BIOSIS Previews; Aquatic Sciences and Fisheries Abstracts; Life Sciences Collection; National Technical Information Service; Dissertation Abstracts International; SciSearch; Water Resources Abstracts; Zoological Record; Federal Research in Progress; and Pollution Abstracts. The collection of the Van Oosten Library of the U.S. Fish and Wildlife Service's Great Lakes Fishery Laboratory was thoroughly searched and the following agencies were contacted for and provided additional information: Michigan Department of Natural Resources, Ontario Ministry of Natural Resources and the Canada Centre for Inland Waters. The literature cited sections of relevant papers were also searched. Seventy five papers are listed with authors abstract (in quotation marks), when available and appropriate. Because many of the documents listed may not be easily obtainable at most research libraries, an attempt has been made to put the information relating to the specific scope of this bibliography in the annotation, within reasonable space limitations. All papers listed are in the Van Oosten Library, Great Lakes Fishery Laboratory, Ann Arbor, Michigan.

ACKNOWLEDGEMENTS

I gratefully acknowledge the assistance of the following people: Dr. Bruce Manny, Jarl Hiltunen, Charles Brown, Donald W. Schloesser, Marusia Borodacz, Gale Jamsen, and Judy Lamia.

Aiken, S.G., P.R. Newroth, and I. Wile, 1979. The biology of Canadian weeds. 34. Myriophyllum spicatum L. Canadian Journal of Plant Science 59: 201-215.

Figure 19 indicates Myriophyllum verticillatum in Lake St. Clair.

Beak, T.W., 1959. Biological survey of the St. Clair River. Industrial Wastes 4(5): 107-109.

"This paper describes the methods used in the preliminary survey in interpreting the results and how these results have been used to formulate future plans. Organisms found during preliminary survey: Group 1 - Limnodrilus sp.; Group 2 - Gyraulus sp., Lymnaea sp., Physa sp., Sphaerium sp., Musculium sp., Pisidium sp., Lumbriculus sp., Helobdella stagnalis, Erpobdella punctata, and Glossiphonia sp.; Group 3 - Odonata, Endochironomus sp., Metriocnemus sp., Tendipedes sp., Cryptochironomus sp., Pentaneura sp., Orconectes limosus, Gammarus fasciatus, Asellus sp., Dugesia tigrina, Goniobasis spp., Valvata tricarinata, and Amnicola sp.; Group 4 - Hydropsyche phalerata, Cheumatopsyche sp., Phylocentropus sp., Ephemera sp., Hexagenia sp., Stenonema sp., Baetisca sp., other Ephemeroptera, Isogenus sp., and other Plecoptera."

Beal, W.J. and C.F. Wheeler, 1891. Michigan flora. Annual Report of the State Board of Agriculture of Michigan 13: 471-650.

Lists Lythrum alatum Push, Utricularia minor L., Potamogeton fluitans Roth, Potamogeton zizii, Potamogeton lucens, and Potamogeton pusillus L. in the Detroit River.

Beal, W. J., 1904. Michigan Flora. Michigan Academy of Sciences Report 5:1-147.

Lists specifically in the Detroit River, Lake St. Clair or the St. Clair River: Potamogeton, duckweed, pickeral weed, Lythrum alatum Pursh and Myriophyllum alterniflorum.

Brown, Charles L., 1983. Productivity of aquatic macrophytes and associated periphyton in Lake St. Clair: a data report. U.S. Fish and Wildlife Service, Great Lakes Fishery Laboratory, 41 p., 1983.

"This study was conducted in 1979 and 1980 to define the contribution of aquatic macrophytes to fish production in Anchor Bay, Lake St. Clair. Macrophyte surface area, dry weight, ash-free dry weight, and net productivity were measured. I describe the methods used in the study and summarize the data collected."

Campbell, D.H., 1886. Plants of the Detroit River. Bulletin of the Torrey Botanical Club 13: 93-94.

A list of plants from the following families: Protophyta, Zygophyta, Oophyta, Carpophyta, Pteridophyta, and Phanerogamia.

Christian, John Irvan, 1968. Ecology and life cycle observations of water-mites found inhabiting Unionid clams in Lake St. Clair. Senior

Thesis, Department of Biology, Alma College, Alma, MI. 24 p.

"The Unionicola in a diverse community of Unionids in Lake St. Clair do appear to be host specific. The data would indicate that specificity is based on certain inherent biological characteristics of the host, and is not the product of any long standing evolutionary trend."

Cole, Leon J., 1903. The delta of the St. Clair River. Geological Survey of Michigan, volume 9, part 1: 1-28.

Brief, general description of bullrushes, cat-tail, grasses, and sedges observed.

Cole, Leon J., 1905. The German carp in the United States. Appendix to the report of the Commissioner of Fisheries to the Secretary of Commerce and Labor for the year ending June 30, 1904, pages 523-641, Plates I-III.

Early observation on destruction of submerged vegetation (esp. Vallisneria) in St. Clair Flats by carp.

Dawson, Steven A., 1975. Waterfowl food production and utilization in Anchor Bay, Lake St. Clair, Michigan. Master of Science Thesis, University of Michigan, Ann Arbor, 124 p.

Includes standing crop biomass of macrophytes and benthic algae, and biomass estimates of 37 macroinvertebrate taxa in Anchor Bay.

Dodge, C. K., 1900. Flora of St. Clair County, Michigan and the western part of Lambton County, Ontario. Michigan State Horticultural Society Annual Report 29: 231-313.

"A glance at the map will show that this locality must be productive of many species, including as it does a number of miles of the Lake Huron shore, both banks of the St. Clair River, much of the north shore of Lake St. Clair, and extending back many miles east and west from the St. Clair River." Listed by family with selected notes on habitat.

Dodge, C.K., 1916. The flowering plants, and fern allies growing without cultivation in Lambton County, Ontario. Michigan Academy of Science Report 16: 132-200.

"On the borders of Lake St. Clair, along the several mouths of the St. Clair River and on the delta islands, the bogs, coves, small bays, and large areas of shallow and apparently rather stagnant water, are sufficiently permanent and free from variations to encourage the growth of all plants fitted to thrive under such conditions. The pondweeds (Potamogetons) flourish, about 27 species or forms having been noticed and in many places on the borders of Lake St. Clair and the mouths of the St. Clair River and often extending out some distance into the

deeper water, the rush, Scirpus occidentalis, is so dense that it is difficult to row a small boat through it. With the latter is often associated an abundance of Equisetum fluviatile, and usually nearer the shore, sometimes however in shallow water or in very wet places, Scirpus validus, S. heterochaetus, Sparganium eurycarpum and Bidens beckii are abundant. In the coves and still water the pickerel-weed, Najas flexilis, water shield, Nymphaea advena and Castalia tuberosa are very frequent and Eleocharis quadrangulata occasional. In very wet places, for at least part of the year, and often as it appears in strips, or in the beds of old but now mostly discontinued streams, the common reed (Phragmites communis) is abundant, and is very striking feature of the vegetation when in bloom. The renowned Indian rice Zizania palustris L., and Vallisneria spiralis, known among sportsmen as wild celery, both known to furnish valuable food for wild ducks, are found, the former plentiful in spots, the latter common everywhere in shallow water. Another plant, Sagitaria latifolia, sometimes known as swan root, the root or rootstock of which is said to furnish food for ducks and swans, is very common in mud and shallow water."

Environmental Control Technology Corporation (ENCOTEC), 1974. Water pollution investigation: Detroit and St. Clair Rivers. U.S. Environmental Protection Agency, Enforcement Division, Chicago. EPA-905/9-74-013, 348 p.

"This report presents the results of a historical review and water

quality survey of the St. Clair and Detroit Rivers. It includes a three-dimensional, steady-state model for the Detroit River, which will allow for the projection of future water quality based on the results of various management schemes for the Detroit area. The historical survey illustrate a gradual upgrading of water quality in the region over the past decade, as a result of pollution abatement programs. The water quality surveys performed have provided heretofore lacking or dated information with regards to the biological communities and sediment chemistry."

Farwell, O.A., 1901. A catalogue of the flora of Detroit. Michigan Academy of Science Report 2: 31-68.

"In the canals, rivers, and ponds may be seen the water lilies, the milfoils, the potamogetons and the utricularias; the low marshy grounds give rise to the buttercups, lilies and sedges; while such plants as the St. John's wort, composite and figworts are usually found growing on the drier grounds." Includes a list of species and their location.

Farwell, O.A., 1918. Rare or interesting plants in Michigan. Report of the Michigan Academy of Science 19: 251-262.

Noted Lycopus asper on the banks of the Detrot River at Wyandotte.

Farwell, O.A., 1938. Notes on the Michigan Flora. VII. Papers of the Michigan Academy of Science 23: 123-134.

Notes Butomus umbellatus L. in marshes along the shores of the Detroit River, where it has long been established. Prior to the Ford Motor Co. operations at River Rouge it covered acres of marshes.

Foerste, A.F., 1883. Plants of Belle Isle, Michigan. Botanical Gazette 8: 202-203.

Notes mostly terrestrial species. Does list Zizania aquatica, Wolffia columbiana, Lemna trisulca, and Lemna polyrrhiza.

Goodrich, Calvin and Henry Van der Schalie, 1932. The naiad species of the Great Lakes. University of Michigan Occasional Papers of the Museum of Zoology No. 238: 8-14.

The list for Lake St. Clair includes: Alasmidonta calceolus (Lea), Amblema costata plicata (Say), Anodonta grandis footiana (Lea), Anodontoides ferussacianus buchanensis (Lea), Dysnomia triquetra (Rafinesque), Elliptio dilatatus sterkii Grier, Fusconaia flava parvula Grier, Lampsilis siliquoidea (Barnes), Lampsilis ventricosa canadensis (Lea), Lasmigona costata eriganensis Grier, Leptodea fragilis (Rafinesque), Ligumia nasuta (Say), Ligumia recta (Lamarck), Micromya iris (Lea), Obovaria olivaria (Rafinesque), Obovaria leibii (Lea), Pleurobema cordatum pauperculum (Conrad), Proptera alata (Say), Ptychobranchus fasciolare (Rafinesque), and Truncilla truncata (Rafinesque).

Hamdy, Y.S., J.D. Kinkead and M. Griffiths, 1977. Water quality assessment of the Thames River mouth, Lake St. Clair, 1975. Ontario Ministry of the Environment, 30 p.

"The localized impact of the Thames River on the water quality of Lake St. Clair results from its nutrient and solids load and bacterial contamination from upstream sources. The Thames River is a minor contributor to the enrichment of Lake St. Clair since its nutrient load represents 1% relative to the input from the St. Clair River. Sediments in the study area were relatively uncontaminated, except for elevated levels of zinc, organic carbon and nitrogen found at the river mouth. The zinc and organic carbon levels exceeded MOE guidelines (19) for open-water disposal of dredged materials. The zoobenthic community in the area was characterized by the presence of pollution intolerant organisms suggesting that the Thames River has little deleterious effect on the benthic community (Appendix B). A total of 13 taxa were identified from 7 stations. The oligochaete Limnodrilus maumeensis, a species common in streams, was the most abundant organism recovered. Next in abundance were members of the chironomidae, primarily Procladius and Cryptochironomus. The occurence of the pollution intolerant mayfly Hexagenia bilineata in significant numbers is indicative of good water quality conditions. The benthic community reflected low levels of contaminants in sediments."

Harlow, George L., 1965. Report on pollution of the Detroit River,

Michigan waters of Lake Erie, and their tributaries. Summary, conclusions, and recommendations. Pages 756-851 IN Proceedings of the Conference in the matter of pollution of the navigable waters of the Detroit River and Lake Erie and their tributaries in the State of Michigan. Vol. 3. U.S. Department of Health, Education, and Welfare, Public Health Service.

"Composition of bottom organisms in the Detroit River changed from a pollution-sensitive population typically found in clean waters to a predominantly pollution-tolerant population in the lower areas of the River below Zug Island and the Rouge River. This change was especially pronounced along the United States shore. In the reach of the Detroit River from Zug Island to the mouth, habitats suitable for the support of a variety of bottom organisms have been destroyed by the deposition of organic solids and oils, especially in areas nearest the Michigan shore. Clinging and burrowing mayfly nymphs, both pollution-sensitive organisms associated with clean bottom conditions, in themselves valuable as fish food, were completely absent from the River below the Rouge River and Detroit Sewage Treatment Plant and in the entire Michigan waters of Lake Erie. Habitats in the lower Detroit River formerly suitable for the support of this once-abundant organism have been totally destroyed by pollution."

Hector, Don, 1977. Review of past and existing environmental monitoring programs. Lake St. Clair - St. Clair River. [Ontario] Ministry of

Natural Resources, Lake St. Clair Fisheries Assessment Unit, 127 p.

Details monitoring programs of the Ontario Ministry of the Environment, Ontario Ministry of Natural Resources, Environment Canada, Michigan Department of Natural Resources, Michigan Department of Public Health, U.S. Department of Commerce, U.S. Environmental Protection Agency, U.S. Department of Health, Education and Welfare, International Joint Commission, universities, and private agencies and the parameters of their studies.

Henson, E. Bennette, 1966. A review of the Great Lakes benthos research. University of Michigan Great Lakes Research Division Publication 14: 37-54.

"This review of studies of the Great Lakes is concerned with the bottom fauna. It considers the benthos in terms of geologic time, it approaches the fauna with a zoogeographic aspects, and it reviews the incentives that have materialized bottom fauna studies.

The molluscan clam Sphaerium is examined as a member of the benthos. It is shown that 11 of the 12 species of Sphaerium in North America have been recorded for the Great Lakes and that the species of this genus exhibit nearly a 50 per cent cosmopolitanism. Distributional records of certain species of Sphaerium are examined, and reasons for certain species to be present or absent from localities are discussed. The significance of post-Pleistocene events affecting the distribution of the present fauna is elicited.

The profundal fauna is examined. The species composition in the

profundal zone is uniform in all the lakes except St. Clair. The origin, distribution, and abundance of three profundal species are discussed."

Herdendorf, Charles E., Suzanne M. Hartley, and Mark D. Barnes, eds., 1981. Fish and wildlife resources of the Great Lakes coastal wetlands within the United States. Volume 4. U.S. Fish & Wildlife Service, Biological Services Program, FWS/OBS-81/02-v4, 792 p.

"This volume concerns the coastal wetlands of Lake Huron and the St. Clair River, Lake St. Clair and the Detroit River. Each wetland has been described in terms of its physiographic, biotic, and cultural characteristics. Biotic components: vegetation; fish; invertebrates; amphibians; reptiles; avifauna; mammals; and endangered species."

Hiltunen, Jarl K., 1971. Limnological data from Lake St. Clair, 1963 and 1965. U.S. National Marine Fisheries Service Data Report 54, 45 p.

"Data, primarily benthological, are given for collections made at 14 stations. Included are records or water transparency, water temperature, water samples for chemical analysis, and bottom samples for the analysis of the macrobenthos."

Hiltunen, Jarl K., 1980. Composition, distribution, and density of

benthos in the lower St. Clair River, 1976-1977. U.S. Fish & Wildlife Service, Great Lakes Fishery Laboratory Administrative Report 80-4, 28 p.

"Analysis of 456 bottom samples collected with a ponar grab at 38 stations in the St. Clair River from the village of St. Clair, Michigan, downstream to Lake St. Clair revealed a diverse and abundant macrozoobenthos fauna, except at the few stations where the substrate contained oil wastes. The Oligochaeta and immature insects were the most abundant invertebrates observed. Dredging proposed at the mouth of the river's North Channel would destroy or displace macrozoobenthos populations whose total densities range from about 4,000 to 45,000 organisms per square meter. Recolonization would be prevented if only hard substrate remained after dredging. Macrozoobenthos constitute a major source of food for fish and waterfowl in the lower St. Clair River. Hence their extensive loss (without replacement) from the important water body, as a result of dredging, ice scour, dewatering, or other activities related to the enhancement of winter navigation, can be expected to have detrimental effects on the fishes and waterfowl that inhabit it. "

Hiltunen, Jarl K. and Bruce A. Manny, 1982. Distribution and abundance of macrozoobenthos in the Detroit River and Lake St. Clair, 1977. U.S. Fish and Wildlife Service, Great Lakes Fishery Laboratory Administrative Report 82-2, 87 p.

"In this study of the macrozoobenthos in the Detroit River and Lake

St. Clair (including Anchor Bay) in April and July 1977, we identified a total of 71 invertebrate taxa, 46 of which were common to both the river and the lake. Some fauna, including the Oligochaeta, chironomid larvae, and the polychaete worm, Manayunkia speciosa, were widely distributed throughout both water bodies. Other taxa, such as Hyalella azteca, Asellus sp., and Lirceus sp. were found primarily in Anchor Bay. Between 1963 and 1977, the density of oligochaetes increased in parts of Anchor Bay while the density of sphaeriid clams declined throughout the lake. In the Detroit River, the macrozoobenthos in Ontario waters included pollution-intolerant ephemeropterans and was, in general, more diverse than that in Michigan waters. The low density of macrozoobenthos and the high percent composition (93%) of pollution-tolerant oligochaetes in Michigan waters of the river indicated that these waters were severly impacted by pollution. Comparison of oligochaete densities reported in earlier surveys of Michigan waters of the Detroit River with those found in the present study, showed that one area just above the mouth of the Ecorse River (station 301) was more heavily polluted in 1977 than it was in 1957 but that there had been little change in the percent composition of oligochaetes elsewhere in the river during this period. The number of benthic invertebrate taxa in open waters of Lake St. Clair (57), was higher than in the Detroit River (49). The Oligochaeta was the most abundant group in the lake (including Anchor Bay) but the low relative abundance of this group there (25-49% of the total number), indicated that the benthic environment in the lake was relatively unpolluted. Immature insects, a preferred food of many fish in the Great Lakes, were relatively abundant and widely distributed throughout the lake."

Hunt, George S., 1957. Causes of mortality among ducks wintering on the lower Detroit River. Ph.D. Thesis, University of Michigan, Ann Arbor, 296 p.

"There were two objectives to this research. First, to determine the causes of mortality among ducks wintering on the lower Detroit River. Second, to determine the effects of environmental factors on the growth, availability, and distribution of aquatic plants and invertebrates used as food by the ducks."

Includes maps and lists of aquatic plants and invertebrates from the lower Detroit River. Also compares previous studies of the same area.

Hunt, George S., 1962. Seasonal aspects Berchtold's pondweed. Michigan Botanist 1:35.

"In July, 1953, large and tangled masses of this pondweed were noted floating downstream on the surface of the lower Detroit River in the vicinity of Grosse Isle in southeastern Michigan. Windrows of the plant were found along the shores of the river. Portions of the floating and windrowed masses were green and apparently living, even though detached from the substrate. In a matter of a few days all of this material had disintegrated and was unidentifiable. The large areas of river shallows where Berchtold's pondweed had flourished rooted to the substrate were now free of it and in its place wild celery (Vallisneria americana Michx.) and, to some extent, sago pondweed (P. pectinatus L.) were found."

Hunt, George S., 1962. Water pollution and the ecology of some aquatic invertebrates in the lower Detroit River. University of Michigan Great Lakes Research Division Publication No. 9: 29-49.

"A study regarding waterfowl, their habitat, and their foods was conducted in the vicinity of Grosse Ile, Mich., during 1948 to 1956. This paper reports the findings made on water quality, underwater soils, and macroscopic invertebrates. Particular effort was made to determine the relationship of snails and fingernail clams to the intensity of water pollution, to other water conditions, and to soils. Bottom samples were collected during 1954 to determine the kinds and numbers of invertebrates in the area studied. A map of the invertebrate aggregations was constructed from the sample data in conjunction with a U.S. Lake Survey chart and aerial photographs. It was concluded that the area studied had attained the benthic climax for large rivers (Gersbacher 1937). The area was suitable for aquatic invertebrate life for the most part. However, the entire Grosse Ile area was polluted to some degree and the northwestern part was very polluted. The degrees of pollution in different parts of the area studied are related to Patrick's (1949) work."

Hunt, George S, 1963. Wild celery in the Detroit River. Ecology 44(2): 360-370.

Hunt found wild celery, sago pondweed, waterweed, Berchtold's pondweed-water milfoil, muskgrass, water-stargrass, stubby wapato, and Illinois pondweed in transects and sites surrounding Grosse Ile.

Jaworski, Eugene and C. Nicholas Raphael, 1976. Modification of coastal wetlands in southeastern Michigan and management alternatives. Michigan Academician 8(3): 303-317.

Includes maps showing extent of wetlands in Lake St. Clair, 1873 and remaining wetlands in Lake St. Clair, 1973. Has a figure detailing vegetation transects on the lower St. Clair River delta between Harsens Island and Muscamoot Bay July 1972 and October 1974.

Jaworski, Eugene and C. Nicholas Raphael, 1978. Fish, wildlife, and recreational values of Michigan's coastal wetlands. Michigan Department of Natural Resources, Great Lakes Shorelands Section, 209 p.

"According to the 1972 shoreland inventory, the state has 105,855 acres of coastal wetland or 3.3 percent of Michigan's total wetlands. Historically, Little Bay de Noc, Les Cheneaux Islands, Saginaw Bay, Lake St. Clair, and the Detroit River/Lake Erie (Monroe County) had 70,125 acres of coastal wetlands. These areas now total 28,522 acres. In these investigated areas, the wetland loss totalled 41,550 acres. Based on the present market price, the value of the dollar loss totals $45,133,687. This loss, however, does not include dollar losses for fish, wildlife and nonconsumptive recreation which is estimated to be $20,346,619."

Jones, Jody. J., 1982. Potential effects of winter shipping on diving ducks wintering in the Detroit River. Master of Science Thesis, University

of Michigan, Ann Arbor, 91 p.

"Potential threats in three main categories: 1) the effects of winter navigation on waterfowl food resource (macroinvertebrate and plant communities); 2) the possible effects of ice breaking and diversion activities on food availability; and 3) the effects of changes in food availability on the physiological condition and survival of wintering waterfowl. Benthic organisms were collected on the lower Detroit River at two-month intervals between Nov. 1979 and May 1981 at sampling sites that had a history of waterfowl use."

Lyon, John Grimson, 1979. Analyses of coastal wetland characteristics: The St. Clair Flats, Michigan. Master of Science Thesis, University of Michigan, Ann Arbor, 107 p.

"Two approaches to wetland quality analysis were examined. In the first approach, the coastal wetlands of the St. Clair River delta were delineated with aerial photography. The wetland types were described with both the Michigan Land Cover/Use Classification System and the National Wetlands Inventory Classification System. The second approach examined the capability of computer classification of LANDSAT digital data to provide coastal land use and vegetation community information. The value of these approaches for wetlands inventory and utility of the classifications is addressed. In addition, classification of LANDSAT data provided a matrix of vegetation community information which can be used as variables in modeling efforts. To demonstrate their information

supplying capabilities, vegetation community classifications were employed as a data matrix for a proposed habitat quality rating model."

MacLaren (James F.) Ltd., 1979. Environmental monitoring of dredging and containment: Southeast Bend Cutoff Channel, Seaway Island, St. Clair River. Willowdale, Ontario. v.p. Done for Public Works Canada.

"The monitoring programme was designed to detect any changes in mercury distribution in the environment which might result from the mercury in the dredged soils. To this end, samples of both living matter and inert materials were to be taken and analyzed. Aquatic macrophyte samples were collected on 1 August 1978 at four locations as indicated in Figure No. 2. It was originally intended to sample the same two species at each location but this was not possible due to the local distribution patterns. Macro-invertebrate samples were collected, from August 1 to 3, 1978, using a Ponar dredge at the 19 locations shown in Figure 2."

Manny, Bruce A. and Donald W. Schloesser, 1982. Great Lakes scientists monitor invasion of Eurasion watermilfoil. Coastal Oceanography and Climatology News 5(1): 9-10.

"Problems encountered elsewhere following large-scale invasion of Eurasian watermilfoil have not yet materialized in the St. Clair-Detroit River waterway. The spread of the plant into the lower Detroit River

coincided at a few locations with declines in the abundance of two native macrophytes: coontail, Ceratophyllum demersum, and redhead grass, Potamogeton richardsonii, the latter being a prefered food of waterfowl (Schloesser and Manny 1982). However, aerial surveys, conducted annually by the U.S. Fish and Wildlife Service indicated that the distribution and abundance of overwintering waterfowl throughout the St. Clair-Detroit Waterway did not change appreciably during the 1970's."

Michigan Department of Natural Resources, 1975. Dickinson Island waterfowl management project involving low-level diking with appropriate water level control structures and pumps in St. Clair Flats Wildlife Area, Clay Township, St. Clair County. Unpublished report.

"Approximately 1,130 acres are "marsh type" habitat (Fig. 3,4,5). Much of the area may be dry during low water periods. At the present high lake levels this area is composed of large unbroken expanses of cattail interspersed with islands of bullrush arrowhead, button bush, pickerel weed, pond weeds, celery, elodea, water lily, chara and other plants. Plankton, numerous forms of aquatic insects, such as mayflies, stone flies, caddis flies, midges, dragonflies, ect., as well as crustaceans and mollusks are abundant throughout the marsh."

Michigan Department of Natural Resources, Wildlife Division, 1977. State of Michigan environmental assessment for purchase and management

of the St. John's Marsh Wildlife Area. Michigan Department of Natural Resources, Wildlife Division, 76 p.

"Approximately 2,000 acres of the area has aquatic associated flora. During low water level periods on Lake St. Clair, much of the marsh is dry with vegetation changes occurring. During normal or high water periods the vegetation is cattail, bullrush, sedge, rice cattgrass, arrowhead, button bush, pickeral weed, pondweed, wild celery, ecodea, water lily, chara, duckweed, green algae and other plants. During dry periods the vegetation will be dominated by sedge meadows containing forbs, grasses, etc. The flora and fauna within the marsh has the affinity to blot up and utilize the nutrients entering the marsh from the watershed. Various types of plankton and numerous forms of aquatic insects, such as mayflies, stoneflies, caddis flies, midges, dragonflies, ect. occur in the project area. There are also crustaceans and mollusks found in numbers throughout the marsh and the aquatic habitats."

Michigan Water Resources Commission, 1967. Water resources uses: present and prospective for St. Clair River, Detroit River, Lake Erie, Maumee River Basin and water quality standards and plan of implementation. Michigan Department of Conservation, 153 p.

"In the good quality water of the St. Clair River varied populations of pollution-sensitive benthic animals are produced together with significant numbers of pollution-tolerant aquatic worms. The numbers of

worms present reflect the quantity of incompletely broken-down organic materials mixed with the sediments. The bottom fauna of Lake St. Clair is dominated by sensitive scuds and the more tolerant aquatic worms, fingernail clams, and midges. Sensitive burrowing mayfly nymphs occur throughout the lake. In the Detroit River the headwaters bottom fauna is characterized by a variety of organisms, including many pollution sensitive forms. In the Belle Isle vicinity the character of the bottom fauna populations commences to change. From that point downstream into Lake Erie the bottom fauna is dominated by more tolerant forms. In Lake St. Clair there are extensive beds of ribbon grass (Vallisneria) and pondweeds (Potamogeton) which serve as waterfowl food. Occasionally floating mats of these plants will accumulate and drift onto beaches where they may interfere with swimming. They are also a minor hazard to boating. Large beds of pondweeds are established around the island regions of the lower Detroit River. Seasonally these weeds break loose and form huge floating mats which can interfere with small boat traffic and become a nuisance if deposited on beaches. The high production of aquatic plants is probably of much more value to the waterfowl populations than it is hazard to pleasure boaters and bathers."

Michigan Water Resources Commission, 1969. Ecorse River water quality study, May-June, 1969. Michigan Water Resources Commission, Bureau of Water Management, 41 p.

"The mouth of the Ecorse River is influenced greatly by the Detroit

River as much intermixing takes place. Sludgeworms were the only animal life present and were extremely dense (3,620 lbs/acre). Five biological sampling stations were located in the inshore waters of the Detroit River near the mouth of the Ecorse. These stations contained extremely high densities of sludgeworms (3,790 to 5,970 lbs/acre). High productivity levels of snails and leeches were found at two locations upstream from the Ecorse River. The data are limited for defining the effects of the Ecorse River discharge on the Detroit River. Immediately downstream from the Ecorse River (station 13) the absence of snails and leeches and the presence of black organic sludge which emitted sewage odors indicates a definite area of degredation. Collections from two other stations (12 and 14) indicate a distinct possibility of biological depression resulting from Ecorse River flow when their community structures are compared to two stations (10 and 11) located upstream from the Ecorse River."

Michigan Water Resources Commission, 1975. Limnological survey of the Michigan portion of Lake St. Clair, 1973. Michigan Water Resources Commission, 59 p.

"The Michigan portion of Lake St. Clair was sampled by the Michigan Department of Natural Resources during July 10-12, August 13-16 and September 10-12, 1973. Physical, chemical and biological water quality indicators were evaluated to document existing water quality. The benthic and planktonic assemblages in the open water portion of the lake

indicate high water quality. Faculative organisms dominated the benthic community and intolerant macroinvertebrates were common throughout the open lake. Plankters common to oligotrophic conditions but capable of tolerating moderate enrichment were dominant throughout the survey. The Clinton Spillway area of Lake St. Clair was eutrophic as indicated by: high total phosphorus and chlorophyll concentrations; low diversity of benthic macroinvertebrates with pollution tolerant oligochaetes and chironomids dominant; and high algal densities with the phytoplankton assemblage dominated by Stephanodiscus, which is common to enriched situations."

Mikula, E. J., 1968. Importance of Celeron Island to waterfowl. Michigan Department of Conservation, Game Division Information Circular No. 149, 2 p.

"As an indication of the importance of the Celeron Island feeding area, we have the results of studies which show how much food this area produces and how much is consumed by waterfowl. Ecological research on this portion of the Detroit River and parallel research in other parts of North America have produced rather valuable information. It has been determined that the standing crop of wild celery tubers in the waters surrounding Celeron Island approximate 485 pounds per acre, with an additional 870 pounds per acre of other edible vegetative material produced by wild celery and potamogeton. In addition, there is a normal production of 52 pounds of mollusks and 55 pounds of other invertebrates

per acre. From this information we calculate that the Celeron feeding area produces an annual crop of 922,000 pounds of wild celery and potamogeton, and 72,800 pounds of bottom fauna in the form of mollusks and other aquatic invertebrates."

Modlin, Richard F. and John E. Gannon, 1973. A contribution to the ecology and distribution of aquatic acari in the St. Lawrence Great Lakes. Transactions of the American Microseopical Society 92 (2):217-224.

"Aquatic Acari were investigated in Lakes Michigan, Huron, Superior, and St. Clair: Benthic, planktonic, and neustonic habitats were sampled. The number of known water mites in the Great Lakes was increased to 21 genera and 32 species. However, water mites are generally low in abundance in the Great Lakes. The scarcity of aquatic vegetation is an important limiting factor. Benthic littoral and sublittoral habitats had the greatest numbers of individuals and species. Species composition and biomass diminished rapidly with depth. Hygrobates longipalpis and Lebertia porosa were most abundant and widely distributed in benthic habitats. Piona rotunda and Unionicola crassipes were most common in the plankton and Hydrozetes, Limnohalacarus, and Soldanellonyx were unique to the neuston."

Mudroch, A. and J. Capobianco, 1978. Study of selected metals in marshes on Lake St. Clair, Ontario. Archiv fuer Hydrobiologie 84(1): 87-108.

"Relationship between the concentration of Zn, Pb, Cu, Cr, Ni, Co, and Cd in sediments and marshwater, and the uptake of these metals by selected plants (Typha latifolia, Carex lacustris, Pontederia cordata, Lythrum saicaria, Nymphaea odorata, Myriophyllum heterophyllum and algae Chara sp.), growing in the marshes located on the east shore of Lake St. Clair was investigated over one growing season. Accumulation of metals in plants varied from species to species, and was affected by the metal concentration in the sediment and marshwater in a complex way. Variations in metal uptake by the same species growing in different plant communities were noticed. Myriophyllum heterophyllum and algae Chara sp. accumulated larger amounts of metals (except for Zn) than the other plants. Metal concentrations in roots of Typha latifolia, Lythrum salicaria, and Pontederia cordata were found to be higher than those in the aboveground biomass."

Mudroch, A., 1979. Uptake of mineral nutrients by Cladophora sp. and Oscillatoria sp. grown on polluted bottom sediments. Unpublished manuscript, Canada Centre for Inland Waters.

"The effects of two types of contaminated bottom sediments from lower Great Lakes on the uptake of major, minor, and trace elements by Oscillatoria sp., Cladophora sp., Anabaena sp., and Pediastrum sp. were investigated with the electron microprobe."

Mudroch, A., 1981. A study of selected Great Lakes coastal marshes.

Canada, Inland Waters Directorate Scientific Series No. 122, 44 p.

"Dover, St. Lukes and Balmoral marshes on the northeastern shore of Lake St. Clair and part of the marshy area in the St. Clair River delta were four of the six study sites. The nutrient and trace element concentration changes in marsh water, the geochemistry of sediments, and the nutrient and trace element uptake by marsh plants and their biomass production were investigated."

Newton, Michael E., 1967. Preliminary report on biological conditions and water quality in the St. Clair River, October 25-26, 1967. Michigan Water Resources Commission, 3 p.

"Observations made on qualitative benthic samples collected from the St. Clair River at mile points 9.7 (Sta. 8)S, 11.0 (Sta.7)N, 13.5 (Sta. 6), 17.5 (Sta. 5), 26.4 (Sta. 4), 31.4 (Sta. 3), 36.6 (Sta. 2), and 39.6 (Sta. 1) showed that significant numbers of pollution-sensitive macroinvertebrates is usually considered indicative of good water quality. Chemical analyses of water samples collected from mid-channel six inches below the river surface at the above stations also demonstrated that the water in the St. Clair River was of good quality. (Table 1)."

Ontario Ministry of the Environment, 1979. St. Clair River organics study, biological surveys 1963 and 1977. Ontario Ministry of the Environment Water Resources Assessment Unit, London, Ont., 90 p.

"A marked improvement in water quality as reflected by bottom fauna production has occurred between 1968 and 1977 in the St. Clair River. A resurgence of bottom-dwelling life forms was evident in the nearshore waters along the Canadian shoreline as evinced by increased numbers and a greater variety of taxa, along with a reduction of the degradation zone of the river. A considerably reduced zone of severe impairment was still evident in 1977 along the Canadian shoreline where benthic organisms generally accepted as sensitive to pollution were absent and those most tolerant to pollution were predominant. Wastes discharged from Canadian sources were found to impact only on nearshore Canadian waters and biota since the strong currents of the shipping channel do not allow for detectable transboundary movement. It is considered that the recovery of bottom fauna has been a direct result of reductions in the volume and improvements in the quality of industrial and municipal discharges to the river along the Canadian shoreline."

Pieters, A. J., 1894. The plants of Lake St. Clair. Michigan Fish Commission Bulletin No. 2: 1-10 + map.

"The flora of Lake St. Clair is arranged in more or less well marked zones limited by the depth of the water, and having certain plants characteristic of each zone. The shallow water and the gradual slope of the bottom give rise to a somewhat mixed flora. The Characetum covers the bottom throughout that part of the lake studied. It is probable that this is true for most of the lake. The distribution of

the plants is dependent primarily upon the depth of the water. The distribution of the Characeae is dependent also upon the character of the bottom, a sandy bottom being unfavorable and a clay or alluvial one favorable to their growth. The structure of the submersed plants is such as to enable them to meet the two conditions present in the deeper water. These conditions are the mechanical effects of the waves and currents and the feeble light."

Reighard, Jacob E., 1894. A biological examination of Lake St. Clair. Preliminary account of work done during the summer of 1893 by the party maintained by the Michigan Fish Commission. Michigan Fish Commission Bulletin No. 4: 1-60.

Includes the following appendices: 1. A list of the Protoza and Mollusca, by Frank Smith; 2. The Cladocera, by E.A. Birge; 3. The worms, by H.B. Ward; 4. The Acarina and Insecta, by R.H. Wolcott; 5. Suggestions for an experimental method of determining the efficiency of quantitative nets, by J.E. Reighard.

Rolan, Robert G. and Edwin J. Skoch, 1976. Biological characteristics. Section 8, pages 239-322 IN Great Lakes Basin Framework Study Appendix 4: Limnology and Embayments. Great Lakes Basin Commission.

Table 4-58 lists the number of species in major taxa of zooplankton, zoobenthos, and periphytic invertebrates in the Great Lakes, including

Lake St. Clair. Table 4-61 lists the abundance of invertebrates in the lower Detroit River.

Roller, N.E.G., 1976. Changes in the wetlands and land-use patterns of St. John's Marsh, St. Clair County, Michigan. Environmental Research Institute of Michigan, prepared for the Michigan Department of Natural Resources Wildlife Division. 8 p.

"The wetlands and land-use of the St. John's Marsh area, Michigan have been classified and inventoried using photo-interpretation techniques applied to 1938 ASCS black-and-white 1:20,000 and 1974 NASA-ERIM natural color 1:10,000 aerial photography. Changes in the variety and extent of wetlands were investigated. The classification system used was the Michigan Land cover/use Classification System. Minimum type mapping size was 1 acre."

Schloesser, Donald W., 1982. Seasonal growth of submersed aquatic macrophytes in the St. Clair-Detroit River Ecosystem. U.S. Fish & Wildlife Service, Great Lakes Fishery Laboratory Administrative Report 82-5, 23 p.

"Growth of submersed macrophytes was determined using samples collected approximately monthly from April to November 1978 at seven locations in the St. Clair-Detroit River Ecosystem. At all seven locations, submersed macrophyte biomass was low in April and May,

increased during early summer, peaked between July and October, and decreased by late November. Maximum seasonal biomass of submersed macrophytes at six of the seven locations (118-427 g/m^2 dry weight) was similar in range to that found in other rivers at similar latitudes. Seasonal growth of common submersed macrophyte taxa represented in the samples followed one of three patterns at each of the seven locations: at two locations plants grew monospecifically; at two locations plants grew sympatrically without species succession; and at three locations plants grew sympatrically with species succession. Differences in growth and succession could, in some instances, be attributed to the presence of overwintering plant material, life cycle differences, and competition."

Schloesser, Donald W. and Bruce A. Manny, 1982. Distribution and abundance of submersed aquatic macrophytes in the St. Clair-Detroit River ecosystem. U. S. Fish & Wildlife Service, Great Lakes Fishery Laboratory Administrative Report 82-7, 49 p.

"An extensive survey was conducted in fall 1978 at 595 stations throughout the St. Clair-Detroit River Ecosystem (SCDRE) to determine the distribution and relative abundance of submersed aquatic macrophytes. Macrophytes were widely distributed in the SCDRE, being found at 68% of all stations; 88 and 90% of the stations in the St. Clair River and Anchor Bay, respectively, and 16 and 58% of the stations in the Lake St. Clair and the Detroit River, respectively. Macrophyte beds of higher

density were found in the St. Clair and Detroit rivers than in Anchor Bay or Lake St. Clair proper. In the St. Clair and Detroit rivers, macrophyte beds adjacent to river channels used by commercial vessels passing between Lakes Huron and Erie (shipping channels) were generally less dense than those adjacent to river channels not used by commercial vessels (non-shipping channels). Of the 19 macrophyte taxa identified, 9 were abundant, being found at 6-37% of all stations. In decreasing order of abundance these taxa were: Vallisneria americana, Characeae, Potamogeton richardsonii, Myriophyllum spicatum, Elodea canadensis, Heteranthera dubia, narrow-leaved Potamogeton spp., Najas flexilis, and Potamogeton gramineus. The greatest change in the species composition of macrophytes in the SCDRE over the last 70-80 years, has been the appearance of an exotic species, Myriophyllum spicatum, that has invaded the river system and is now the fourth most abundant plant."

Stuckey, Ronald L., 1968. Distribution history of Butomus umbellatus (flowering-rush) in the western Lake Erie and Lake St. Clair region. Michigan Botanist 7:134-142.

Known distribution of Butomus umbellatus L. in the Detroit River, Lake St. Clair and western end of Lake Erie.

Stuckey, Ronald L., 1969. The introduction and spread of Lycopus asper (western water horehound) in the western Lake Erie and Lake St. Clair

region. Michigan Botanist 8:11-120.

Known distribution of Lycopus asper Greene in the western end of Lake Erie and Lake St. Clair region.

Surber, E.J., 1955. Results of a biological survey of the Detroit River. Michigan Water Resources Commission, 15 p.

"The presence of mayfly nymphs and caddisfly larvae on the American side indicated that the water was of at least fair quality above the mouth of the Rouge River. In the A Range, there was more evidence of pollution on the Canadian side. Below the mouth of the Rouge River and Ecorse Light, there was evidence of gross pollution. At Buoy 7, tubificids occurred in record numbers. Between this point and the mouth of the river, the bottom animals were midgefly larvae, mayfly nymphs, caddisfly larvae, and other clean-water animals. The data for the series of eight samples collected from Maple Beach eastward showed gross pollution on the American side for at least 4,000 feet from the Beach. Beyond, a fertilizing effect was noted. This was accompanied by an abnormally large and varied population of bottom animals."

Sweeney, Robert A., 1976. Bibliography concerning Great Lakes attached plants. Great Lakes Laboratory, Buffalo, NY, 31 p.

Lists 377 papers.

Texas Instruments Incorporated, Ecological Services, 1975. Report of fish and macrozooplankton studies on the St. Clair River in the vicinity of the proposed Belle River Power Plant. Prepared for Detroit Edison. Texas Instruments Inc., Dallas, v.p.

"In May 1974, the Ecological Services branch of Texas Instruments Incorporated initiated a 1-year study of the fishes and macrozooplankton of the St. Clair River to provide Detroit Edison Company with information on compositions and spatial and temporal distributions of fishes and macrozooplankton in the St. Clair River near the proposed Belle River Power Plant site and the existing St. Clair Power Plant. The area in which the investigation was conducted was a section of river extending from approximately 0.5 km upstream of the mouth of Bowens Creek to approximately 0.7 km downstream of the St. Clair Power Plant. Three transects were established in relation to the intake and discharge for the proposed Belle River Power Plant and the thermal discharge of the St. Clair Power Plant. Three sampling stations were located on each transect with one near each shore and one at midriver. An additional sampling station was located on the American shore approximately 680 m south of the St. Clair Power Plant to serve as a downstream control station in order to ascertain effects of the thermal discharge from the St. Clair Power Plant on fish distribution in this section of the river. During summer months, extensive beds of submerged aquatic macrophytes were noted along both shores except in the vicinities of the St. Clair Power Plant on the American shore, Station SB1, and the discharge structure located near Station SC1 on the Canadian shore. The beds

generally extended from near shore out into the 15- to 20-ft water depths. A qualitative examination of samples taken from the submerged plant beds indicated that principal constituents were Chara (an alga), Myriophyllum (watermilfoil), Eloda (waterweed), Pontederia (pickerelweed), and Najadaceae (pondweeds)."

Thornley, S. and Y. Handy, 1983. An assessment of the bottom fauna and sediments of the Detroit River. Ontario Ministry of the Environment, 48 p.

"Differences over time were detected in the macrozoobenthos of the Detroit River comparing 1968 and 1980 data. There was an increase in the types of organisms recovered in 1980, particularly along the Canadian shoreline. Also, certain organisms indicative of satisfactory water quality such as the mayfly, Hexagenia limbata, were better represented in the river in 1980. The mayfly was found at 70% of stations in 1980 compared to only 26% in 1968. The recovery of the mayfly was particularly noticeable in the centre and along the Canadian shoreline of the river and is indicative of improved conditions. The occurence of mayfly along the American shoreline, although somewhat improved in 1980, was still meager compared to stations in the middle of the river and along the Canadian shoreline. Satisfactory water quality conditions are still not evident along most of the American shoreline."

Tilton, Donald L., Robert H. Kadlec, and Benedict R. Schwegler, 1978.

The ecology and values of Michigan's coastal wetlands. Michigan Department of Natural Resources, Great Lakes Shorelands Section, 98 p.

Discusses aquatic macrophytes in Anchor Bay, Lake St. Clair, pages 26-27.

U. S. Army Corps of Engineers, Detroit District, 1980. Final Environmental Impact Statement, Belle River Power Plant, St. Clair County, Michigan. U.S. Army Corps of Engineers Detroit District, v.p.

"The benthic macroinvertebrates found in the St. Clair River in November 1977 are listed in Appendix E-2. The community is homogeneous. Dominant invertebrates were the snail Goniobasis sp., and the caddisflies Cheumatopsyche sp., and Brachycentrus americanus. The samples taken near the St. Clair Power Plant discharge were somewhat depressed in biomass and indicated the presence of the pollution tolerant annelid Oligochaeta. The low diversity of the invertebrate community is most likely due to relatively constant environmental conditions, such as flow and substrate, existing in the St. Clair River."

U. S. Army Engineer Detroit District, 1974. Final Environmental Statement, proposed diked disposal area on Dickinson Island, St. Clair County, Michigan. U. S. Army Engineers Detroit District, 235 p.

Attachment 6 is "Natural plant communities of the St. Clair delta," by E. Jaworski, 1972.

U. S. Fish & Wildlife Service, 1970. National Estuary Study, Volume 5, Appendix G:85-94. U.S. Fish and Wildlife Service, Washington, D.C.

"The bottom fauna of Lake St. Clair includes many species representative of most major taxonomic groups of aquatic organisms. It is similar to a shallow inland lake. Mayflies are abundant in most areas. Fingernail clams, unionid clams, leeches, midge larvae, snails, worms (oligochaetes and polychaetes) are widely spread throughout the lake bottom but not uniformly abundant. Changing water quality and aquatic environment conditions affect populations of these organisms. Oligochaetes are especially abundant at the mouth of the Thames River. A tiny polychaete worm (Manayunkia speciosa) is found throughout the lake but is especially abundant near the Detroit River. The presence of numerous benthic organisms along with extensive beds of aquatic vegetation provides a rich supply of foods for fish and wildlife."

U. S. Fish & Wildlife Service, 1977. Great Lakes connecting channels follow-up study. U. S. Fish and Wildlife Service, Great Lakes Region, Twin Cities, MN, 56 p.+

Details biological information about the St. Clair River, Lake St. Clair, and the Detroit River, drawing the information from many other publications.

U. S. Public Health Service, 1962. Pollution of waters of the United

States in Lake St. Clair, the Detroit River, and western Lake Erie in the Detroit area. Robert A. Taft Sanitary Engineering Center, Cincinnati, Ohio, 78 p.

The figure opposite p. 66 details the number of bottom organisms per square foot at 14 stations in the Detroit River, October 18-19, 1955. Sludge worms are the only species mentioned specifically.

Van der Schalie, Henry, 1975. An ecological approach to rare and endangered species in the Great Lakes region. Michigan Academician 8(1):7-22.

Lists mussel Dysnomia sulcata in Lake St. Clair and the St. Clair River, freshwater snail Amnicola binneyana in Lake St. Clair, and mussel Dysnomia triquetra in Lake St. Clair.

Vaughan, Richard D., 1965. Bottom organisms. Pages 343-350 & 563-567 IN Proceedings of the Conference in the matter of pollution of the navigable waters of the Detroit River and Lake Erie and their tributaries in the State of Michigan, Volume 2. U. S. Department of Health, Education, and Welfare, Public Health Service.

Their survey of bottom organisms of the Detroit River found caddisfly larvae, mayfly nymphs, muscles, snails, fingernail clams, scuds, midge larvae, leeches, and sludgeworms at various locations.

Vaughan, R. D. and G. L. Harlow, 1965. Report on pollution of the Detroit River, Michigan waters of Lake Erie, and their tributaries. U.S. Department of Health, Education, and Welfare, Public Health Service, Division of Water Supply and Pollution, Grosse Ile, Michigan, 341 p.

"Evaluation of the bottom fauna in the Detroit River from its headwaters to its mouth shows a change from a community of clean-water associated organisms above significant sources of pollution to a community of predominately pollution-tolerant organisms below known sources of pollution. Pollution from industrial and domestic sources causes this significant change in population composition, and damages habitats for desirable bottom-dwelling organisms."

Voss, Edward G., 1966. Checklist of aquatic vascular plants of Michigan. University of Michigan Herbarium, 7 pages.

"Included here are all true submersed and floating aquatics known to occur in Michigan, plus most if not all species of marshes and wet shores." Locations not given.

Voss, Edward G., 1972. Michigan Flora: Part I; gymnosperms and monocots. Cranbrook Institute of Science, Bloomfield Hills, MI. 488 pp.

Mentions some plants in waters of the Great Lakes.

Williamson, Brooks B., 1979. The wetlands of Dickinson Island, St. Clair County, Michigan, and their response to water level fluctuations. M.S. Thesis, Eastern Michigan University, Ypsilanti, MI. 79 p.

"Aerial photography and field transects provided data for examination of wetland vegetation and changes in zonal distribution due to fluctuations in water level. High (1975) and low (1964) water periods were examined and a discernable trend was revealed. Dominant plant communities shifted and compacted to a landward position on Dickinson Island of St. Clair County, Michigan, during high water levels, whereas the same communities moved lakeward during low water periods. These changes result in a faunal change, as well, which is discussed. A qualitative model is proposed relating water depth, substrate type, and wave energy to vegetation changes."

Woodworth, W. McM., 1896. Preliminary report on the collections of Turbellaria from Lake St. Clair and Charlevoix, Michigan. Michigan Fish Commission Bulletin No. 6, Appendix IV: 94-95.

Planaria maculata, Mesostoma wardii, and Vortex armiger were found at "New Baltimore, Lake St. Clair, August 20, 1893."

Woodworth, W. McM., 1896. Report of the turbellaria collected by the Michigan State Fish Commission during the summers of 1893 and 1894. Harvard College Bulletin of the Museum of Comparative Zoology 29(6): 239-243.

The following were found in samples from New Baltimore, Lake St. Clair, August 20, 1893: Planaria maculata, Mesostoma wardii, and Vortex armiger.

Wright, Stillman, 1955. Limnological survey of western Lake Erie. U.S. Fish & Wildlife Service Special Scientific Report Fisheries No. 139, 341 p.

Sampling of bottom organisms of two regular stations and a number of special stations in the Detroit River during 1929 and 1930 produced Tables 95-99. Tubificidae, Hexagenia, Chironomidae, Sphaeriidae, Gastropoda, Hirudinea, Trichoptera, Bithynia, Valvata, Amnicola, Musculium, Pisidium, and Sphaerium are listed by number per square meter.